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Table IV., where this expectation is realized.) Dominance here has apparently shifted from the white to the yellow character. It would be a matter of great interest to know how the character would behave in later generations and whether the altered dominance may not be due to some independent factor interchangeable between white and yellow. We get no evidence of such a condition elsewhere in Kellogg's experiments, and the numerical proportions of the yellows and whites in these two broods are a slender basis on which to base such a hypothesis, but these two broods would form a good starting-point in looking for an explanation, if they were followed into later generations.

Kellogg's experiments seem to the writer to be of value not in respect to their double mating feature, which really has produced nothing at variance with the results of single matings, but in their demonstration, in common with Coutagne's experiments, of varying dominance, a matter as yet quite obscure and affording inviting material for further study. It is to be hoped that Professor Kellogg will not fail to put on record the further data mentioned in his paper.

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June 7, 1911

WHAT IS WHITE AND BLACK ALKALI?

THE popular distinction between "white" and "black" alkali salts in soils is of considerable practical importance, and anything that tends to confuse the farmers' ideas in this respect is regrettable; doubly so when official publications of experiment stations or the Department of Agriculture at Washington lend countenance to such confusion. The cultivation and reclamation of lands affected by alkali salts is comparatively simple when the alkali is "white," but always more risky and difficult when these are "black," and in the latter case are sometimes economically impracticable.

In a general way, black alkali is sodium carbonate, which after dissolving the humus

of the soil, leaves black spots on the land where the solution has evaporated; while white alkali leaves only the white crust of the sulfate and chloride of sodium. Broadly speaking, the sulfate is quite four times less injurious to vegetation than the carbonate, while common salt stands in between in this respect.

Some years ago, it was stated in an official publication, that an observer had "discovered" that bicarbonate (hydrocarbonate) of sodium was frequently present in alkali salts; and as laboratory experiments had shown that the bicarbonate was not more injurious than the other two "white" salts, it should, therefore, be considered as part of the latter. And having been the first to investigate alkali lands in this country, I have been censured for overlooking such obvious facts, giving lands containing the bicarbonate an undeserved bad name.

Now any one familiar with the occurrence and behavior of the three sodium carbonates—the normal or monocarbonate, the sesquicarbonate (so-called) or trona, and the hydro- or bicarbonate, can readily understand the reason why I have considered the presence of either of these compounds in the soil equivalent to that of the others. The only one of them that occurs as a mineral in nature, and is stable under natural conditions, is the sesquicarbonate, occurring as trona wherever a solution of either of the other two evaporates spontaneously in the presence of atmospheric air. The monocarbonate absorbs carbonic dioxide from the air whenever exposed, so that when we want to obtain an accurately weighed quantity of the normal carbonate, we must first ignite it. On the other hand, the bicarbonate begins to lose carbon dioxide as soon as exposed to moist air, and upon evaporation its solution leaves a residue of sesquicarbonate, which acts practically as though it contained the normal carbonate, in dissolving humus, causing injury to vegetation, and puddling the soil.

It is thus obvious that, supposing a soil to contain a solution of bicarbonate only, the latter will, so soon as it is raised to the sur-

face by capillarity, at once begin to lose carbon dioxid, leaving a residue of sesquicarbonate; which will, without difficulty, dissolve the humus of the soil, and act in other respects precisely like the normal carbonate.

In view of the fact that the air of the soil always contains more carbonic dioxid than the air, any sodic carbonate it contains in solution will inevitably suffer transformation into bicarbonate to the extent to which carbonic acid happens to be found in the soil under the existing conditions of vegetable growth, temperature, moisture, and bacterial action in the oxidation of organic matter. It is a matter purely of seasonal accident; so that, if a soil sample happens to be taken at a time when carbon dioxid is abundantly forming, the chemist may find in it exclusively bicarbonate; while similar samples, taken a few weeks afterwards, may under the influence of aeration and drying, be found to contain, in the main, the sesquicarbonate.

I have therefore considered, and do now consider, the determination of *sodium bicarbonate* in the soils as quite immaterial for practical purposes, it being a variable and entirely uncertain factor; and inasmuch as ultimately the entire amount of sodic carbonates may serve for the formation of sesquicarbonate and the normal salt, I have thought best to calculate the entire amount of these carbonates found to the latter salt, without reference to the other two.

Of late, the official characterization of the hydrocarbonate salt as no more harmful than other white alkali, has led some chemists analyzing irrigation waters to recommend for that purpose, waters containing considerable amounts of sodium bicarbonate. In this case, the prospect of the accumulation of indefinite amounts of black alkali in the soil irrigated would be such a positive and inexcusable detriment, that it seems high time to put an end to the misleading statement which leads chemists, as well as farmers, to expose lands to serious injury.

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BERKELEY, CAL.,
June, 1911

METALS ON METALS, WET

It is generally agreed that the coefficient of friction between metals (outside the physical laboratory) is a very elusive quantity. It is with the hope of suggesting some considerations not mentioned by Professor Hall¹ but of great practical importance that the following comments are offered.

The difference in coefficient of friction between driving wheel and rail, whether the latter is wet or dry, is relatively immaterial so far as the effect of using sand to prevent the slipping of the driving wheels is concerned. Sand is used on dry as well as wet rails, with a similar result in either case, namely, to increase the coefficient of friction between wheel and rail. The reason for this is obvious, since the sand particles become ground between the two surfaces, giving them, in effect, the roughness which greatly increases the coefficient of friction over that of the unsanded smooth surfaces.

It is also well known to railroad engineers that a cleanly washed wet rail, as after a heavy rain, is a "better" rail and is less likely to result in slipping of wheels than a perfectly dry rail. Of course a rail having slimy water or any foreign matter, such as coal dust, frost, etc., which can act as an ungent, results in lowering the coefficient of friction. It is because a wet rail is ordinarily greasy that sand is commonly used when the rail is wet, whereas, a dry rail is more apt to be gritty, due to the dust, etc. There is therefore less necessity for using sand.

Referring to Professor Hall's paragraph one, would not term "adhesion"² apply to the phenomena mentioned more accurately than term "friction"? A similar effect is noticed when a thin film of water separates two plates of glass.

Professor Hall's conclusion would seem to satisfactorily account for one phase of the problem, but, as stated above, the phenomenon

¹ SCIENCE, May 19, 1911, p. 775.

² See DuBois, "Mechanics of Engineering," Vol. 1, p. 220.